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REMARKS

Claims 1 to 10 and 31 to 34 are pending. No claims are allowed and claims 31 to 47 are new. Claim 9 is canceled.

1. The Applicants would like to thank Examiner Raymond Alejandro for the time he took on December 17, 2003, to discuss the merits of the application and pending claims with their attorney. The substance of the interview is as set forth by the Examiner in the Interview Summary of November 17, 2003.

2. Claim 3 is rejected under 35 USC 112, second paragraph. The indefinite language noted in this claim by the Examiner has been amended.

Reconsideration of this rejection is requested.

3. Claims 1 to 10 are rejected under 35 USC 102(b) as being anticipated by Ono et al. (U.S. Patent No. 6,001,507). Ono et al. describes a non-aqueous electrolyte secondary battery. The active material of at least one of the anode and the cathode has a binder integrated therewith. At column 5, lines 42 to 55, the cathode active materials are exemplified by FeS_2 , TiS_2 , MoS_2 , V_2O_5 , V_6O_{13} , MnO_2 and LiCoO_2 . The examples beginning at column 8, line 10 relate solely to LiCoO_2 and FeS_2 .

The binder is made of a mixture of polyimide in which conversion to imide has been completed. As taught at column 3, line 65⁺, the polyimide has been converted into imide at

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least before it is mixed with the depolarizing mix. At column 2, lines 30 to 35, the Ono et al. patent states that when polyamic acid is heated to form an imide, water is generated. This water "adversely affects the active material, as a result of which the discharge capacity of the non-aqueous electrolyte battery and the cycling characteristic of the non-aqueous electrolyte deteriorate excessively." For this reason, Ono et al. believed it best to convert the polyamic acid to the polyimide and thereby drive off water before mixing the product polyimide with the electrode active material.

In contrast, the Applicants claimed electrochemical cell includes an electrode characterized as having been made from an admixture of either a first electrode active material of the general formula $SM_xV_2O_y$ or a second electrode active material of the general formula $Cu_xAg_yV_2O_z$ mixed with a halogenated polymeric material as a first binder and a polyamic acid precursor of a polyimide second binder. The electrode active admixture containing the unconverted polyamic acid precursor is first press contacted to a current collector and then cured at a temperature of at least about 140°C . Silver vanadium oxide (SVO) is an exemplary active material coming under the purview of the first general formula.

At the outset, the Applicants wish to state that while Ono et al. may have believed their patented invention applicable to a wide range of active materials represented by those listed in the patent, namely, FeS_2 , TiS_2 , MoS_2 , V_2O_5 , V_6O_{13} , MnO_2 , LiCoO_2 , that is simply not the case. The Applicants assert the Ono et al. patent would have lead one skilled in the art in a completely different direction than

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their presently claimed invention. Silver vanadium oxide and MnO_2 are known to have substantially similar discharge characteristics. In fact, they are both used extensively in cells powering implantable medical devices, especially those that from time to time require a high current pulse application, such as needed by a cardiac defibrillator. This is because the exemplary SVO active material is of a substantially similar theoretical faradic capacity (Ah/g.) as MnO_2 , which is listed by Ono et al.

Regarding this point, the Examiner's attention is directed to U.S. Pub. No. 2002/0098411 to Gan et al. This application is assigned to the assignee of the present invention and claims a cathode construction of MnO_2 /current collector/SVO/current collector/ MnO_2 . Lithium/ MnO_2 cells have nearly as good of pulse discharge rate capability as Li/SVO cells with diminished Rdc and voltage delay, but they are known to have cell-swelling problems. Nonetheless, both materials are recognized by skilled artisans in the implantable medical device field as being comparable materials, with SVO probably being favored somewhat more than MnO_2 , predominately because of the latter's swelling problem. The point is that while MnO_2 and SVO are often seen as nearly equal cathode active materials for implantable cells, they function in an entirely different manner in respect to the Applicants' invention. Further, V_2O_5 and V_6O_{13} (listed by Ono et al.) are often used as starting materials combined with a silver-containing material to produce SVO.

Turning to the application Examples III to VI beginning at page 18, the attributes of a cell manufactured by the

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presently claimed protocol with the representative active material silver vanadium oxide are set forth. In every example, a homogenous mixture of silver vanadium oxide and a carbonaceous diluent is mixed with a slurry comprising PVDF and polyamic acid. The resulting active slurry is then coated onto a current collector foil. As summarized at page 21, line 26 to page 22, line 2, it is important to the Applicants' invention that the resulting electrode assembly be first pressed then cured to benefit significantly higher pulse minimum voltages than cells containing electrodes that were cured then pressed.

Proof that a step protocol of press contacting followed by curing is important to a properly functioning secondary cell, as well as to a primary cell, is found in Comparative Example 4 of the cited Ono et al. patent beginning at column 10, line 64. This example describes a secondary cell comprising LiCoO_2 as a cathode active material mixed with polyamic acid and PVDF. These ingredients were formed into a slurry applied to both sides of an aluminum foil current collector. The resulting assembly was then dried (cured) such that "the polyamic acid was completely converted into polyimide. Then, the aluminum foil was compressed by the roller press so that the cathode 2 was manufactured."

The cell was then subjected to a temperature change shock test and cycle test. At column 14, lines 1 to 9, Ono et al. conclude that this cell functioned in an unacceptable manner. The reason is that when "the polyamic acid was completely converted into imide by drying the slurry of the depolarizing mix for the cathode applied to the collector in a state where

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the temperature was raised, [there was] encountered generation of water which adversely affected the active material of the cathode. Therefore, the discharge capacity at the 10th cycle deteriorated and the cycle characteristic as well deteriorated."

At column 17, line 15⁺, a primary cell is described comprising FeS₂ as an active material combined with PVDF and polyamic acid in a slurry. The slurry was applied to both sides of an aluminum current collector foil and dried at a temperature such that the "polyamic acid was completely converted into polyimide. Then, the aluminum foil was compressed by the roller press so that the cathode 2 was manufactured."

In a similar manner as the above-described secondary cell, this primary cell was subjected to a temperature change shock test and cycle test. As described in Comparative Example 4, the primary cell performed in an unacceptable manner. The Ono et al. patent stated at column 19, line 12, "The reason for this lies in that water generated when the polyamic acid is heated and cyclohydrated adversely affected the active material of the cathode."

Thus, independent claim 1 has been amended to set forth that the positive electrode comprises an electrode active material having a general formula of either SM_xV₂O_y or Cu_xAg_yV₂O_z mixed with the halogenated polymeric material first binder and the polyamic acid precursor second binder. This admixture is then contacted to a current collector followed by curing. Ono et al. teaches that the process steps of pressing then curing result in an inferior product. When the positive electrode is

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of an active material having the presently claimed general formulas, the Applicants respectfully disagree. A representative material coming under the purview of these general formulas is silver vanadium oxide. As set forth in the accompanying declaration, water neither chemically reacts with SVO, nor is it absorbed therein. Instead, what is important for a properly functioning electrode and, consequently, an electrochemical cell, is the order in which the electrode active admixture including the binder materials is press contacted to the current collector in comparison to the technique taught by Ono et al.

Accordingly, amended independent claim 1 is believed to encompass patentable subject matter in light of the cited Ono et al. patent. Claims 2 to 8, 10 and 31 to 38 are allowable as hinging from a patentable base claim.

Reconsideration of this rejection is requested.

4. The Applicants request that the Examiner bring the subject matter of claims 11 to 18 back into the application as new claims 39 to 47. In the office action dated May 19, 2003, the Examiner set down his opinion that a restriction between claims 1 to 10 drawn to a cell having specific electrode constituents (invention I) and claims 11 to 18 drawing to an electrode as a subcombination of the cell (invention II) was proper. As support, the Examiner stated that restriction of a combination and subcombination is only proper where: 1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and 2) that the subcombination has utility by itself or in other combinations.

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The Examiner then reasoned that "the combination as claimed does not require the particulars of the subcombination as claimed because invention I directed to an electrochemical cell per se can use either a positive electrode or a negative electrode made from another material other than first and second binders, for example, a positive/negative electrode consisting of a single binder itself; or a positive/negative electrode consisting a polymeric material other than a halogenated polymer or a positive/negative electrode consisting of an active material without organic components such as active materials only containing metallic compounds or inorganic binders."

Given the scope of the presently amended independent claims 1 and 39, it is clear that this is not an entirely accurate assessment of the Applicants' invention. Clearly, both independent claims 1 and 39 now call for "a halogenated polymeric material as a first binder and a polyimide as a second binder". Further, the entire point of section 2 above is to convey that not only does the Applicants' invention consist of these binder ingredients, but the steps by which they are processed is critical to a properly functioning cell product. Thus, the combination (cell) does in fact require the particulars of the subcombination as presently claimed for patentability.

The Examiner admits as much in the office action of October 15, 2003, page 3, section 9 where he states "The present application is directed to an electrochemical cell wherein the disclosed inventive concept comprises the specific binders used therein." This is correct and means that the combination

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as claimed does, in fact, require the particulars of the subcombination as claimed for patentability.

Accordingly, since new independent claim 39 has language similar to that which is believed patentable in independent claim 1, it properly belongs in the present application, and is patentable. Claims 40 to 47 are allowable as hinging from a patentable base claim.

Reconsideration of the restriction is requested.

It is believed that claims 1 to 8, 10, and 31 to 47 are now in condition for allowance. Notice of Allowance is requested.

Respectfully submitted,


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